Saddleback Ridge Wind, LLC // Natural Resource Protection Act (NRPA) and Site Location of Development Act applications

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  Saddleback Ridge Wind Project – Noise Impact Study Peer Review (January 21, 2011)

Saddleback Ridge Wind Project
Noise Impact Study Peer Review

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Review Basis

Saddleback Ridge Wind, LLC proposes to construct, operate and maintain a 33 MW wind energy facility on the ridge of Saddleback Mountain in Carthage, Maine. At the request of the Maine Department of Environmental Protection (MDEP) a peer review is undertaken to determine if the applicant's noise impact assessment is reasonable and technically correct according to standard engineering practices and the Department Regulations on Control of Noise (06-096 CMR 375.10).

It is noted that this review includes supplemental information provided from RSG, Inc. and one conference call.

1.0 Introduction

Resource Systems Group (RSG) submits a noise impact study for the proposed Saddleback Ridge Wind Project (project) assessing effects of wind turbines on sound levels in the areas surrounding the project, land uses in the project vicinity, pertinent noise control regulations and sound estimates for the project operation.

2.0 Project Area

This section briefly outlines the geographical location, terrain, bordering roads and shortest distances between wind turbines and bordering residences.

3.0 A Noise Primer

Informational

4.0 Noise Standards

The appropriate noise control standard is identified, 06-096 CMR 375.10, whereas the Town of Carthage has no quantifiable noise control standard. Relevant Chapter 375.10 details are elaborated. SRW chooses to be regulated by MDEP quiet area noise limits (55 dBA daytime/45 dBA nighttime). No significant (=0.5 dBA) MDEP defined short duration repetitive or tonal sound penalties are expected to be applied.

5.0 Sound Monitoring

5.1 Soundscapes around the Project

Three generalized soundscapes are characterized with respect to the region surrounding the project location.

5.2 Sound Monitoring

The sound monitoring results from monitors A-C are characteristic of similar settings in their respective generalized regions (southwest, southeast and east of the proposed project). Sound monitoring location 1 m anemometers indicated calm to very light ground level wind speeds insufficient to produce significant microphone self noise. No mention is made of distance to or height of nearby trees.

6.0 Meteorological Data

6.1 Weather Events

Meteorological data was collected at 1 m above the ground (monitoring locations A & C), the project met tower (60 m AGL) and 10 m surface measurements from Auburn-Lewiston Municipal Airport (LEW).

6.2 Wind Speeds

Wind shear was calculated from a long-term project met tower with anemometers at 40, 50 and 60 m (AGL). A comparison of wind speeds at ground level (1 m monitoring locations A &C) and predicted hub height (85 m – ridgeline) provide a rudimentary basis to substantiate a general logarithmic wind profile, but otherwise yield insufficient information to conclude the presence or absence of atmospheric decoupling.

6.3 Correlation of Wind Speed and Ambient Sound Level

The generalized relationships depicted in figures 11-13, based on sound monitors A-C are characteristic of similar settings, but may not represent all protected locations surrounding the project under specific conditions.

7.0 Sound Levels Produced By Wind Turbines

7.1 Standards Used to Measure Wind Turbine Sound Emissions

Describes pertinent IEC standards. No tonal sounds are expected based on manufacturer specifications.

7.2 Manufacturer Sound Emissions Estimates

RSG provides manufacturer specified sound power level and incorporates a +2 dBA uncertainty factor. NRO decreased noise operations will be used for turbines 6-10 during nighttime hours, 7 p.m.-7 a.m. to achieve MDEP nighttime noise limits.

8.0 Sound From Wind Turbines - Special Issues

8.1 Wind Turbine Noise

Informational

8.2 Meteorology

Informational

8.3 Masking

The reviewer concurs that some wind masking is expected, especially along the eastern side of the project at higher surface wind speeds.

8.4 Infrasound and Low Frequency Sound

Infrasound is not regulated in Chapter 375.10 Control of Noise and low-frequency sounds are not expected to exceed regulation limits.

9.0 Sound Modeling

9.1 Modeling Software

RSG provides acoustical modeling utilizing Cadna A software employing ISO 9613-2 algorithms. Standard WT modeling practices are employed which include:

- Simultaneous omnidirectional modest downwind propagation, or equivalently during a well-developed moderate ground-based temperature inversion.
- Attenuation due to the geometric divergence, atmospheric absorption, ground interactions and barriers.

It is noted by the reviewer that the project is modeled assuming all ground regions (source, middle, receiver) as reflective surfaces (G=0) in addition to incorporation of the manufacturer's 2 dB confidence interval.

9.2 Modeling results

Modeling results indicate 21 receiver locations (East-South) where the nighttime noise from the project will exceed 40 dBA routinely under predominate wind conditions.

Project operation sound levels are expected to be in compliance for all protected locations during all hours of the day and night (NRO operation).

Eleven protected locations are predicted to receive project operating noise levels from 43-45 dBA. These protected locations range in elevation from approximately 900-1100 feet.

Perceptible low-frequency vibrations and rattle are not expected based on ANSI 12.2-2008, "Criteria for evaluating room noise".

10.0 Short Duration Repetitive Sounds

RSG evaluated a year of data from Saddleback Ridge meteorological tower (anemometers 40, 50 and 60 m) for wind conditions currently held as the cause of significant amplitude modulation (shear and turbulence). Their findings indicated an infrequent occurrence of nighttime conditions likely to cause significant short duration repetitive sounds (SDRS).

11.0 Construction Impacts

Standard discussion

12.0 Summary And Conclusions

Patriot Renewables proposed project on Saddleback Ridge in Carthage, Maine is modeled conservatively to meet the 45/55 dBA noise limits (nighttime/daytime) at surrounding protected locations with the use of noise reduced operation modes.

Conclusion - (Peer Review)

Wind turbine noise predictive modeling utilizing ISO 9613-2 (1996) algorithms is widely used in the international community. Estimated modeling accuracies for greater than 30 m source height and 1000 m distances are not provided in ISO 9613-2, but numerous authors have presented corrections for wind turbine predictive modeling. It is this reviewer's experience and opinion that appropriately corrected ISO 9613-2 algorithms provide reasonable estimates of "worst-case" wind turbine noise that comply with MDEP Chapter 375.10 noise regulations.

Wind turbines sounds are produced by mechanical components and wind turbine blades interacting with a dynamic atmosphere. The mechanical sounds are understood and generally well-controlled, but blade/atmosphere interactions remain a topic of international research and discussion.

"Worst case" compliance measurement conditions occur during temperature inversions, increased wind shear and possibly during WT inflow turbulence.

In my opinion the Saddleback Ridge Wind Project noise assessment is reasonable and technically correct according to standard engineering practices and the Department Regulations on Control of Noise (06-096 CMR 375.10).

The wind project prediction model is based on CADNA/A software, with user input of the following prediction assumptions:

- individual wind turbine hub level spherical wave fronts,
- reflective ground cover attenuation,
- atmospheric attenuation for 10°C, 70% RH
- no attenuation due to foliage,
- all wind turbines operating at maximum or proposed NRO sound power output and
- all wind turbines operating under moderate downwind conditions simultaneously.

Incorporation of an uncertainty factor of + 2 dBA for maximum equipment specification potential inaccuracy and a reflective ground surface assumption results in a reasonable prediction model that estimates most restrictive receiver position sound levels within regulatory limits.

SDRS has not been entirely ruled out, but a full year of ridgeline meteorological data suggests infrequent occurrence. Significant penalties (=0.5 dBA) resulting from SDRS are not expected. Tonal sounds are not expected based on manufacturer specifications.

I recommend:

1. <u>Post construction operation compliance testing representative of two separate regions around the project completed within the first year of operation.</u>

The project is up wind and easterly flanked by approximately 20 protected locations which will be exposed to the entire project, including turbines operating under noise reduced operation mode (NRO).

This region should be monitored both meteorologically and acoustically in no less than three locations representative of nonparticipating receivers and their respective elevations.

The southern terminus of the project is adjacent and up wind to approximately 12 protected locations including those closest to the project.

This region should be monitored both acoustically and meteorologically in a minimum of one location representative of the most impacted nonparticipating receivers and their respective elevations.

Project operation compliance testing should be completed during periods when hardwoods are without leaves.

2. Utilization of a standardized compliance testing methodology

Compliance should be demonstrated, based on following outlined conditions for 12, 10-minute measurement intervals per monitoring location meeting 06-096 CMR 375.10 requirements. All data submittals must be accompanied by concurrent time stamped audio recordings.

a. Compliance will be demonstrated when the required operating/test conditions have been met for twelve 10-minute measurement intervals at each monitoring location.

b. Measurements will be obtained during weather conditions when wind turbine sound is most clearly noticeable, i.e. when the measurement location is downwind of the development and maximum surface wind speeds ≤6 mph with concurrent turbine hub-elevation wind speeds sufficient to generate the maximum continuous rated sound power from the five nearest wind turbines to the measurement location. Measurement intervals affected by increased biological activities, leaf rustling, traffic, high water flow or other extraneous ambient noise sources that affect the ability to demonstrate compliance will be excluded from reported data. A downwind location is defined as within 45° of the direction between a specific measurement location and the acoustic center of the five nearest wind turbines.

c. Sensitive receiver sound monitoring locations should be positioned to most closely reflect the representative protected locations for purposes of demonstrating compliance with applicable sound level limits, subject to permission from the respective property owner(s). Selection of monitoring locations should require concurrence from MDEP.

d. Meteorological measurements of wind speed and direction should be collected using anemometers at a 10-meter height above ground at the center of large unobstructed areas and generally correlated with sound level measurement locations. Results should be reported, based on 1-second integration intervals, and be reported synchronously with hub level and sound level measurements at 10 minute intervals. The wind speed average and maximum should be reported from surface stations. MDEP concurrence on meteorological site selection is required. One second data should be available on request, as required.

e. Sound level parameters reported for each 10-minute measurement period, should include A-weighted equivalent sound level, 10/90% exceedance levels and ten 1-minute 1/3 octave band linear equivalent sound levels (dB). Short duration repetitive events should be characterized by event duration and amplitude. Amplitude is defined as the peak event amplitude minus the average minima sound levels immediately before and after the event, as measured at an interval of 50 ms or less, A-weighted and fast time response, i.e. 125 ms. For each 10-minute measurement period short duration repetitive sound events should be reported by percentage of 50 ms or less intervals for each observed amplitude integer above 4 dBA. Reported measurement results should be confirmed to be free of extraneous noise in the respective measurement intervals to the extent possible and in accordance with (b).

f. Compliance data collected in accordance with the assessment methods outlined above for representative locations selected in accordance with this protocol will be submitted to the Department for review and approval prior to the end of the first year of facility operation. Compliance data for each location will be gathered and submitted to the Department at the earliest possible opportunity after the commencement of operation, with consideration for the required weather, operations, and seasonal constraints.

g. All acoustic, meteorological and audio raw data files should be available for Department review upon request.